

CLAIMS

- 1) A hand-held, electronically controlled injection device (1; 80) for injecting preset doses of liquid medications, comprising a housing (2; 81) which is adapted for receiving a medication container (4; 83) containing the liquid medication, and has a contact surface (16; 97) for contacting a patient's skin, characterized by comprising first actuator means (41; 87) for moving said medication container (4; 83) within said housing (2; 81) to and from said contact surface (16; 97).
10 2) A device as claimed in Claim 1, characterized in that said contact surface (16; 97) of said housing (2; 81) comprises a through opening (30; 98) for receiving a needle assembly (32; 105) comprising a needle (25; 96) and at least one needle housing (31; 104) fitted to said needle (25; 96); and by comprising releasable retaining means (60; 106, 107) for locking said needle housing (31; 104) in a predetermined position engaging said opening (30; 98), both during displacement of said medication container (4; 83) towards said contact surface (16; 97) from a first operating position withdrawn inside said housing (2; 81) to a second operating position connected to said needle (25; 96), and during reverse displacement of said medication container (4; 83) from said second to said first operating position to permit automatic withdrawal of said needle (25; 96) from said needle housing (31; 104).
20 3) A device as claimed in Claim 2, characterized by comprising presence sensor means (67) which generate a presence signal (S2) to activate said first actuator means (41) upon said needle housing (31) engaging said opening (30).
25 4) A device as claimed in Claim 2 or 3, characterized in that said retaining means comprise at least one locking lever (60) movable between

a lock configuration, in which a respective work portion (62) projects inside said opening (30) to interact with said needle housing (31), and a release configuration, in which said work portion (62) is located outside said opening (30).

- 5 5) A device as claimed in Claim 4, characterized in that said locking lever (60) is loaded elastically into the lock configuration; and in that push means (63, 64) are provided to set said locking lever (60) to said release configuration at least in said first operating position of said medication container (4).
- 10 6) A device as claimed in Claim 5, characterized in that said push means comprise cam means (63, 64) interposed between said locking lever (60) and a support (42) for supporting said medication container (4) and which is movable to and from said contact surface (16).
- 15 7) A device as claimed in any one of Claims 2 to 6, characterized by comprising removing means (60, 62) for removing said needle (25) from said medication container (4); said removing means comprising stop means (60, 62) which are activated selectively in a third operating position of said medication container (4), close to said second operating position, to lock said needle (25) and disconnect said needle from said medication container (4) as said medication container (4) moves into said first operating position.
- 20 8) A device as claimed in Claim 7, characterized in that said third operating position is located on the opposite side of said second operating position with respect to said first operating position in the travelling direction of said medication container (4).
- 25 9) A device as claimed in Claim 7 or 8, for connection to a needle assembly (32) comprising a needle support (33) supporting said needle (25) in projecting manner and connectable to one end (24) of said

medication container (4), characterized in that, in said third operating position of said medication container (4), said work portion (62) of said locking lever (60) is interposable between said medication container (4) and said needle support (33) to define said stop means.

5 10) A device as claimed in Claim 2, characterized in that said releasable retaining means comprise at least one releasable retaining member (106) actuated by said needle housing (104) upon insertion of said needle housing (104) into said opening (98), said releasable retaining member(s) (106) retaining said needle housing (104) at least during said
10 displacement of said medication container (83) from said first to said second operating position.

11) A device as claimed in Claim 10, characterized in that said releasable retaining means further comprise an abutment surface (107) for limiting insertion of said needle housing (104) into said opening (98) and
15 for retaining said needle housing (104) during said reverse displacement of said medication container (83) from said second to said first operating position.

12) A device as claimed in Claim 10 or 11, characterized by comprising sensor means (109) for sensing actuation of said releasable
20 retaining member(s) (106).

13) A device as claimed in Claim 12, characterized by comprising means (95, 87) for reversing displacement of said medication container (83) immediately after said sensor means (109) have detected a disengagement of said needle housing (104) from said releasable
25 retaining member(s) (106) during said displacement of said medication container (83) from said first to said second operating position.

14) A device as claimed in any one of Claims 10 to 13, characterized by comprising removing means for removing said needle

(96) from said medication container (83), said removing means comprising stop means (112) which may be activated in said second operating position of said medication container (83) to retain said needle (96) and thus disconnect said needle (96) from said medication container (83) as 5 said medication container (83) is moved from said second to said first operating position.

15) A device as claimed in any one of the foregoing Claims, with said medication container (4; 83) and said needle assembly (32; 105), characterized in that said needle assembly (32; 105) comprises a needle 10 support (33; 99) supporting said needle (25; 96), and in that at least one of said needle support (33; 99) and an end (24; 100) of a medication container unit (4, 42; 82, 83), comprising said medication container (4; 83) and a holder (42; 82) holding said medication container (4; 83) inside said housing (2; 81), is provided with at least one elastic flange (36; 103) for 15 connection of said needle support (33; 99) to said end (24; 100) of said medication container unit (4, 42; 82, 83).

16) A device as claimed in any one of the foregoing Claims, characterized by comprising first sensor means (114, 115, 117; 103a, 121, 122) for detecting proper connection of said needle (96) to said medication 20 container (83).

17) A device as claimed in Claim 16, characterized in that said first sensor means comprise optical transmitter means (114) and first optical receiver means (115) arranged so that, when no needle (96) is properly connected to said medication container (83), a first optical ray (118) 25 transmitted by said transmitter means (114) passes near an end (100) of a medication container unit (82, 83), comprising said medication container (83) and a holder (82) holding said medication container (83) inside said housing (81), to reach said first receiver means (115), and when said

needle (96) is properly connected to said medication container (83), said first optical ray (118) is interrupted by a needle support (99) supporting said needle (96).

18) A device as claimed in Claim 17, characterized in that said end 5 (100) of said medication container unit (82, 83) is truncated (120) to let said first optical ray (118) pass when no needle (96) is properly connected to said medication container (83).

19) A device as claimed in any one of Claims 16 to 18, characterized by comprising second sensor means (114, 116, 117) for 10 detecting partial connection of said needle (96) to said medication container (83).

20) A device as claimed in Claim 19 when dependent on claim 17 or 18, characterized in that said second sensor means comprise said optical transmitter means (114) and second optical receiver means (116) 15 arranged so that, when no needle (96) is connected to said medication container (83), a second optical ray (119) transmitted by said transmitter means (114) passes near said end (100) of said medication container unit (82, 83) to reach said second receiver means (116), and in a configuration where said needle (96) is partly connected to said medication container 20 (83), said second optical ray (119) is interrupted by said needle support (99) while said first optical ray (118) still reaches said first receiver means (115).

21) A device as claimed in Claim 16, characterized in that an end (24; 100) of a medication container unit (82, 83), comprising said 25 medication container (83) and a holder (82) holding said medication container (83) inside said housing (81), is provided with at least one elastic flange (103) for connection of a needle support (99) supporting said needle (96) to said end (100) of said medication container unit (82, 83),

and in that said first sensor means comprise optical transmitter means (121) and optical receiver means (122) arranged so that, when said needle (96) is properly connected to said medication container (83), a reflective portion of one (103a) of said elastic flange(s) (103) reflects an optical ray transmitted by said transmitter means (121) towards said receiver means (122), and when no needle (96) is properly connected to said medication container (83), said reflective portion (103a) reflects said optical ray in a direction not corresponding to said receiver means (122).

22) A device as claimed in any one of the foregoing Claims, characterized by comprising second actuator means (40, 44; 86, 84) which are activated selectively to force the liquid medication contained in said medication container (4; 83) through the patient's skin .

23) A device as claimed in Claim 22, characterized in that said second actuator means comprise an actuator assembly (86) and a push member (84) driven by said actuator assembly (86) and which can be moved axially from a retracted position, located outside said medication container (83), to enter said medication container (83) and push the liquid medication out of said medication container (83) through said needle (96), and then returned to its retracted position, said device further comprising a door (88) which, in its open position, permits insertion/removal of said medication container (83) into/from said housing (81), a door opening mechanism (89, 123, 125, 126, 82) for opening/closing said door (88) and a lock mechanism (94, 129) for locking at least part of said door opening mechanism, to prevent opening of said door, when said push member (84) is inside said medication container (83) and for unlocking said door opening mechanism (89, 123, 125, 126, 82) when said push member (84) is in its retracted position.

24) A device as claimed in Claim 23, characterized in that said lock

mechanism is designed to lock a door opening button (89) of said door opening mechanism (89, 123, 125, 126, 82) when said push member (84) is inside said medication container (83).

25) A device as claimed in Claim 24, characterized in that said lock mechanism (94, 129) comprises a first lever (129) which, in a rest position, locks said door opening button (89) and which is actuated by said push member (84) during retraction of this latter to unlock said door opening button (89).

26) A device as claimed in Claim 25, characterized in that said lock mechanism (94, 129) further comprises a part (94) movable in the direction of displacement of said push member (84) and which, in a rest position, is out of contact with said first lever (129) and, during retraction of said push member (84), is pushed by an end portion (93) of said push member (84) to come into contact with and actuate said first lever (129).

27) A device as claimed in any one of Claims 23 to 26, characterized in that said door opening mechanism (89, 123, 125, 126, 82) comprises a door opening button (89) movable in the direction of displacement of said push member (84), a second lever (125) actuated by said door opening button (89), a locking member (126) movable in said direction, actuated by said second lever (125) and having a first flange (127), and a medication container holder (82) for holding said medication container (83) inside said housing (81), said medication container holder (82) having a second flange (128) designed to cooperate with said first flange (127) and being pivotable with said door (88) from a closed to an open position of said door (88) when said second flange (128) is released by said first flange (127).

28) A device as claimed in any one of Claims 22 to 27, characterized by comprising injection control button means (18), said

button means (18) successively activating said first actuator means (41) to move the assembly defined by the medication container (4) and needle (25) from the first to the second operating position so that the needle (25) penetrates the patient's skin, and said second actuator means (40) to 5 deliver through the patient's skin a preset dose of liquid medication contained in said medication container (4).

29) A device as claimed in Claim 28, characterized by comprising skin sensor means (68) which generate a consent signal (S3) to activate said button means (18) upon interaction between said contact surface (16) 10 and the patient's skin.

30) A device as claimed in Claim 28 or 29, characterized by comprising selecting means (9) for selecting the speed at which said medication container (4) moves towards said contact surface (16) at least as said needle (25) penetrates the patient's skin, and for setting the dose 15 of liquid medication to be injected into the patient.

31) A medication injection device comprising means (82) for receiving a medication container (83) an end (83a) of which is connectable to a needle (96), control means (95) and means (86, 84), controlled by said control means (95), for pushing liquid medication contained in said 20 medication container (83) out of said medication container (83) through said needle (96), characterized by comprising sensor means (114-117; 103a, 121, 122), connected to said control means (95), for detecting proper connection of said needle (96) to said medication container (83).

32) A medication delivery device comprising a housing (81), a door 25 (88) which, in its open position, permits insertion/removal of a medication container (83) into/from said housing (81), a door opening mechanism (89, 123, 125, 126, 82) for opening/closing said door (88), and a push member (84) which can be moved axially from a retracted position, located outside

said medication container (83), to enter said medication container (83) and push liquid medication contained in said medication container (83) out of said medication container (83) to deliver it to a patient, and then returned to its retracted position, characterized by comprising a lock mechanism

5 (94, 129) for locking at least part of said door opening mechanism (89, 123, 125, 126, 82), to prevent opening of said door (88), when said push member (84) is inside said medication container (83) and for unlocking said door opening mechanism (89, 123, 125, 126, 82) when said push member (84) is in its retracted position.